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By Kevin Simon

Image Attribute: Deployment of Natick datacenter, Orkney islands, Scotland, U.K. / Source: Microsoft

On 5th June 2018, Microsoft announced the launch of — *"Northern Isles Data-center"* — self-sufficient underwater data centers, being submerged in a shipping-container-size capsule, 100 ft below the surface of the North Sea near the UK's Orkney islands, fully powered by renewable energy. Orkney islands-*based* **European Marine Energy Centre** has partnered with Microsoft to provide necessary cabling for power supply and internet access to the prototype.
The newly conceptualized underwater data center prototype is **an outcome** of years-long research effort to — *"investigate manufacturing and operating environmentally sustainable, prepackaged datacenter units that can be ordered to size, rapidly deployed and left to operate lights out on the seafloor for years."* It is designed to operate independently without direct human intervention or supervision for up to 5 years at a time, which could be further extended to 20 in near future.

The underwater data center concept was originally presented in a white paper prepared for a Microsoft event called ThinkWeek that encourages employees to share out-of-the-box ideas. Peter Lee, who is a corporate Vice-president of Microsoft AI and Research, and also leads the New Experiences and Technologies (NExT) group, was very much intrigued by the idea.

One of the paper's authors, Sean James, had served in the U.S. Navy for three years on submarines. *"I had no idea how receptive people would be to the idea. It's blown me away,"* says James, who has worked on Microsoft datacenters for the past 15 years, from cabling and racking servers to his current role as senior research program manager for the Datacenter Advanced Development team within Microsoft Cloud Infrastructure & Operations. *"What helped me bridge the gap between datacenters and underwater is that I'd seen how you can put sophisticated electronics under water, and keep it shielded from salt water. It goes through a very rigorous testing and design process. So I knew there was a way to do that."*

Just 12 months after launching *Project Natick* in July 2014, the team had deployed a lab-built proof-of-concept prototype in calm, shallow waters off California. It operated for 105 days under Phase 1.

Image Attribute: Pulling out of Natick Prototype (Phase 1) from the shallow waters off California after 105 days of feasibility testing. / Source: Microsoft
Phase 1 of *Project Natick* showed the underwater data center concept is feasible; Phase 2 *(Orkney islands' prototype)* is focused on researching whether the concept is logistically, environmentally and economically practical.

For the phase 2, Microsoft selected a French industrial group specialized in naval defense and marine renewable energy — **Naval Group.** The Microsoft team presented Naval Group with general specifications for the underwater datacenter and let the company take the lead on the design and manufacture of the vessel. One key design specification was for the vessel itself to have roughly the dimensions of a standard cargo container *(as per ISO*

specification) used to move supplies on ships, trains, and trucks to optimize the existing logistics supply chain.

Naval Group adapted a heat-exchange process commonly used for cooling submarines to the underwater datacenter. The system pipes seawater directly through the radiators on the back of each of the 12 server racks and backs out into the ocean.

Microsoft says it will operate the prototype for 12 months. First, it'll put the servers through a battery of tests to check on power consumption, humidity levels, noise creation, and temperatures. Then the company will let some customers use the data center. If successful, Microsoft will keep operating the servers, and allow its customers to use it to run their own computations.

Image Attribute: Project Natick's Northern Isles datacenter at a Naval Group facility in Brest, France. The data center has about the same dimensions as a 40-foot long ISO shipping container / Source: Microsoft

Project Natick's 40-foot long data center prototype is loaded with 12 racks containing a total of 864 servers and associated cooling system infrastructure, now sits about 22 km (14 miles) from the coast. The data center was assembled and tested in France and shipped on a flatbed truck to Scotland where it was attached to a ballast-filled triangular base for deployment on the seabed.
At the deployment site, a remotely operated vehicle retrieved a cable containing the fiber optic and power wiring from the seafloor and brought it to the surface where it was checked and attached to the data center, and the datacenter powered on.

A cable from the Orkney Island grid sends electricity to the data center, which requires just under a quarter of a megawatt of power when operating at full capacity. The island itself runs exclusively on renewable power generated by its own wind turbines and residential solar panels and is also a sizeable testbed for tidal energy generation.

More than half of the world's population lives within about 120 miles of the coast. By putting data centers in bodies of water near coastal cities, data would have a short distance to travel to reach coastal communities, leading to fast and smooth web surfing, video streaming and game playing as well as authentic experiences for AI-*driven* technologies. Also, oceans are uniformly cool below a certain depth, keeping the machines under the sea would cut down on the cooling costs that make up a large chunk of the operating budget of data centers.

About the Author:

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